Article type: Survey article

Artificial Intelligence in Dentistry - A Survey

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Abstract

Today's artificial intelligence is invading our everyday lives such as digital assistants like ALEXA, SIRI. While we may think about sci-fi imagination when heard about artificial intelligence, the future of Artificial intelligence in dentistry is very real. With the enormous increase in the documented information and patient data, intelligence software and computation of this data is a necessity. While advances in artificial intelligence, neural networking, image recognition, speech recognition, etc have transformed the field of medicine and dentistry in many ways and yet a number of drawbacks, challenges have to be overcome. A self-designed survey study was conducted among 100 individuals of the general population. The questionnaire was designed in the manner to assess their knowledge on the treatment and vaccines for COVID-19 infections. The questionnaire contains a set of 10 questions. These questions were distributed through an online survey link. The study population was well explained about the purpose of this study. The questions were carefully studied and the responses of each individual has been recorded. The results were statistically analysed through an online platform named google forms. The AI has the potential that can be applied in various fields of science. Thus most of participants were aware about the usage of AI in dentistry.

Keywords: *Artificial Intelligence, digital assistance, software, science fiction.*

Introduction

Today's artificial intelligence is invading our everyday lives through digital assistants like ALEXA and SIRI. While we may think about sci-fi imaginations when heard about AI, the future of AI in dentistry is very real . With the enormous increase in the documented information like patient's data, computation of this data through intelligent software is a necessity [1] . From data processing, finding relevant information using neural networks, diagnosis of a particular disease, introduction to augmented reality and virtual reality in dental education. AI has a number of applications in the field of medicine and dentistry, Introduction of robotics in the field of surgery has increased precision and the surgical procedure is predictable. Improvement in the AI, digitization of the new era in the field of dentistry, the future aspects are extremely promising. Augmented reality and virtual reality are used widely in the field of dental education for creating situations that could stimulate clinical work on patients and eliminates all the risks.

Previous researches say that As virtual assistance they perform a number of simple tasks in a dental clinic with a greater precision and less manpower is said by Dr. Sunali S. Khanna [2] , in the year 2017. Some tasks include booking in coordination appointments, alerting

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the patient and dentist about check ups, assisting in clinical diagnosis and treatment. AI is now available in orthodontic diagnosis, treatment planning and treatment monitoring, says Sonali Vijay Deshmukh [3] in the year 2018. In every field like endodontics and implantology, AI has a major role to play in making precise surgical guides. Thus, application of artificial intelligence based on dentistry is not a myth but turning into a reality. AI is used increasingly in the aid of diagnosis in the field of medicine, says PM Speight [4] , et al, in 1995. The value of neural networks in identification of individuals with high risk of oral cancer in clinical examination or health education.

While advances in AI like neural networking, image recognition, speech recognition have transformed the field of medicine and dentistry in many ways, yet a number of drawbacks, challenges to be overcome. The future of AI needs to solve the challenges created by AI. The aim of this study is to analyse the need for AI in the field of dentistry.

Materials and Method

Study Design:

This study setting includes an online survey involving undergraduates of age between 18 - 23 from different locations. Ethical approval and informed consent from the participants is required. The number of people involved are the study participant and analyser, sampling - the sample size of the previous study was 196, a study on patient's awareness towards the role of AI in dentistry, Akanksha Singh [5] , et al, 2019. Power calculation using G power software. The sampling method is stratified random sampling. The measure taken to minimize the sampling bias is stratification and matching independent variables in a selected sample. The internal validity is the usage of a pre tested questionnaire. The external validity is homogenization and replication of the experiment.

Survey Instrumental:

Data was collected. A questionnaire contains a set of 10 questions with a validity checking. Data collection software was used. Data manipulation/ clean up in excel spreadsheet. The list of output variables that are to be assessed are the effect of knowledge, age on the use of AI in dentistry. The method of representation of each output variable is pie chart.

Analytics:

The statistical test used here is the chi square test. The statistical software used is a SPSS [6 7 8 9 10] . The list of independent variables are the knowledge and age. The list of dependent variables is the AI. The type of analysis used is the correlation and association in chi square. The steps followed in software analysis.

Result And Discussion

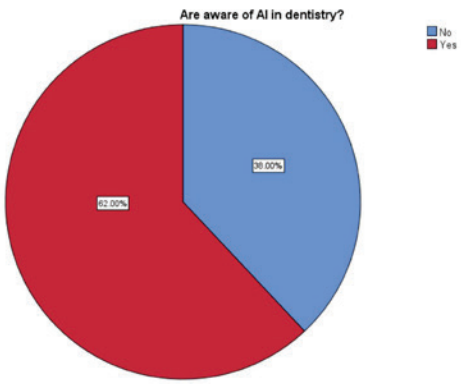

FIGURE 3

Figure 1: Pie chart showing the responses to questions about AI in dentistry. Majority of respondents have replied no (62%). Blue represents no and red represents yes.

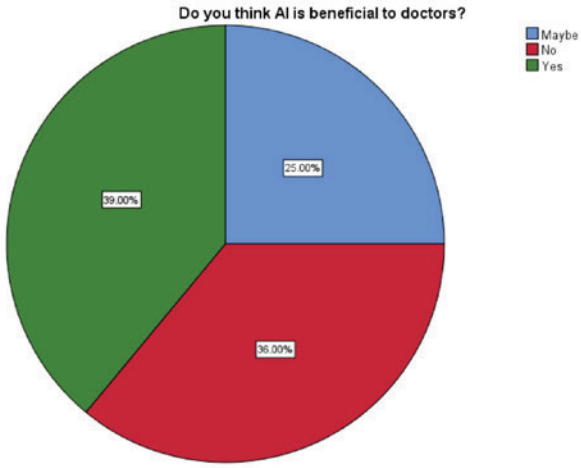

FIGURE 4

Figure 2: Pie chart showing the responses to questions about the benefits of AI to doctors. Majority of the respondents have replied yes (39%)Green represents yes, red represents no and blue represents maybe.

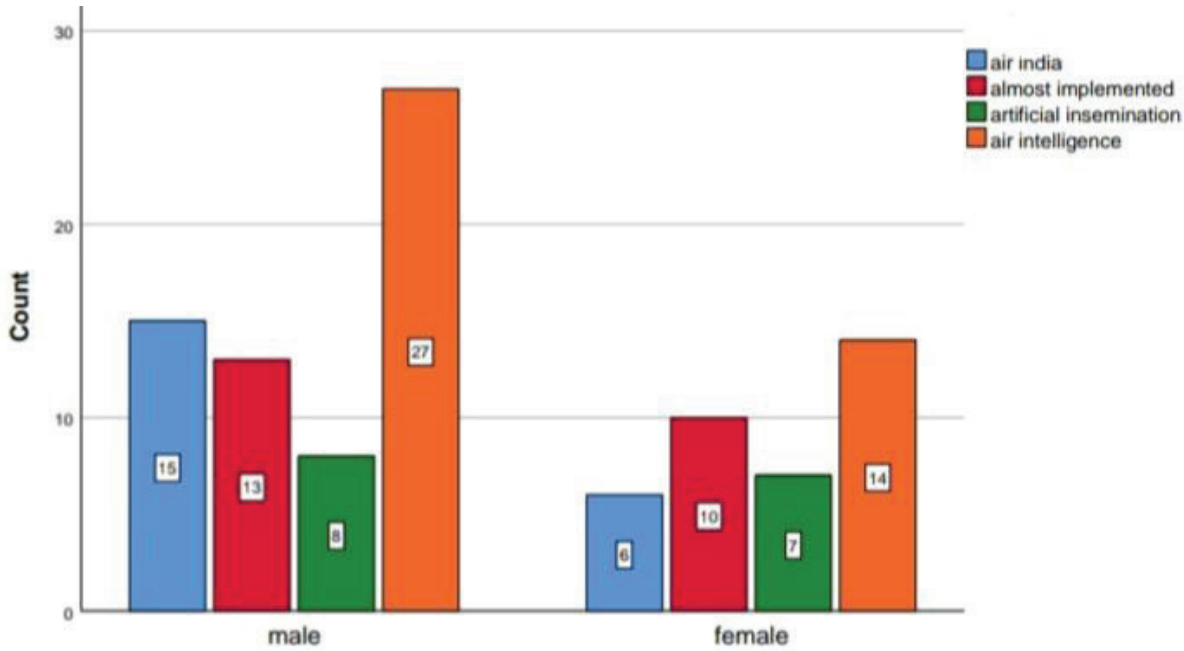

Figure 3: Bar graph showing the comparison of responses based on gender to the questions on abbreviation of AI, where blue represents air india, red represents almost implemented, green represents artificial insemination and orange represents artificial intelligence. Majority awareness responses(27%) were given by males. X-axis represents gender of the participants and Y-axis represents the frequency. There is no significant difference in responses between gender.Pearson Chi square test - 1.799, P value - 0.615(p>0.05- Statistically not significant).

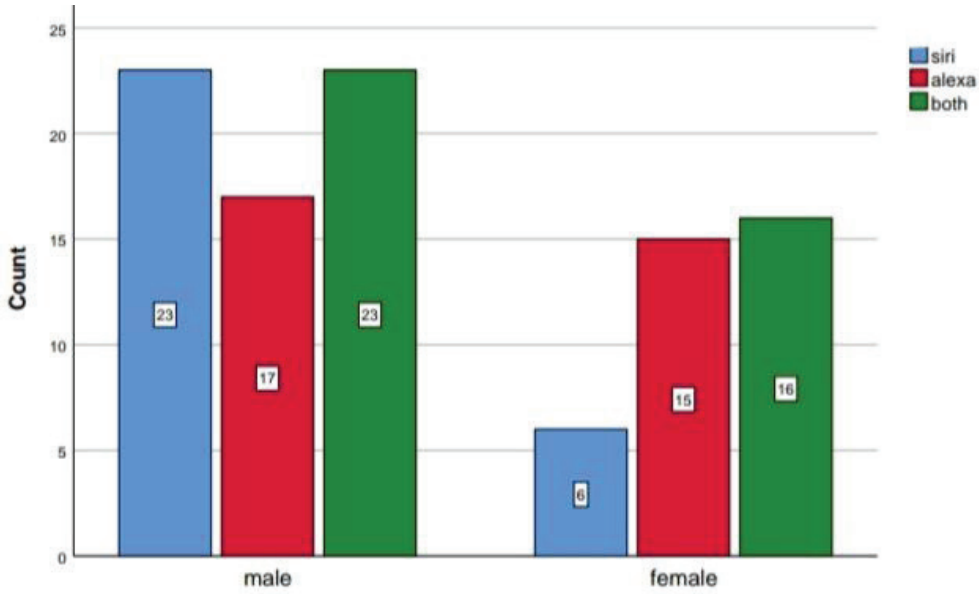

Figure 4: Bar graph showing the comparison of responses based on gender to the questions on the technology of AI like alexa, siri, etc, where blue represents siri, red represents alexa and green represents both alexa and siri. Majority of responses (23%) were given by males. X-axis represents gender of the participants and Y-axis represents the frequency. There are no significant differences in response between gender. Pearson Chi square test - 4.919, P value - 0.085. (p>0.05- Statistically not significant).

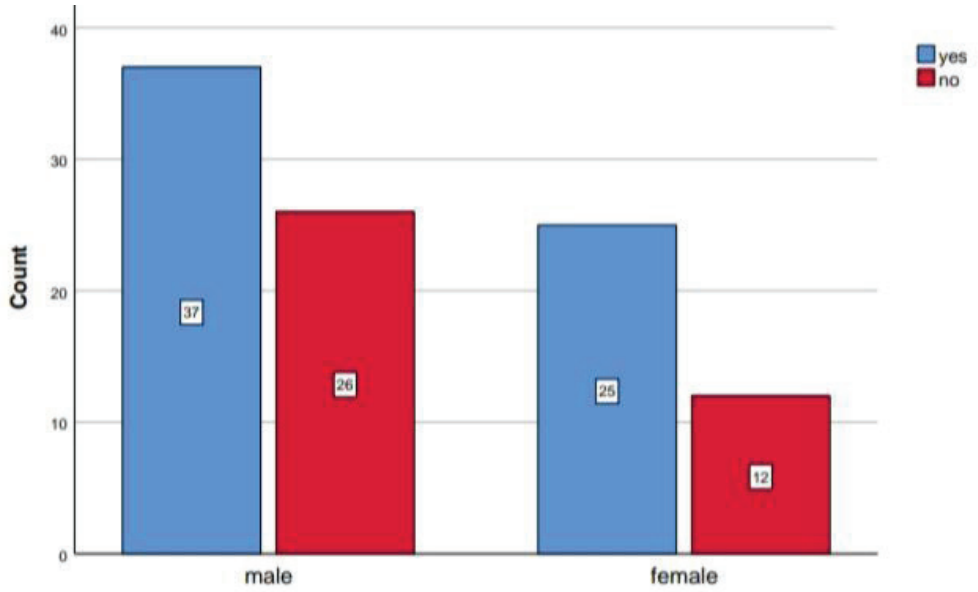

Figure 5: Bar graph showing the comparison of responses based on gender to the questions on the awareness of AI in dentistry where blue represents yes and red represents no. Majority of the responses (37%) were given by males. X-axis represents gender of the participants and Y-axis represents the frequency. There are no significant differences in response between gender. Pearson Chi square value - 0.773, P value - 0.379. (p>0.05- Statistically not significant).

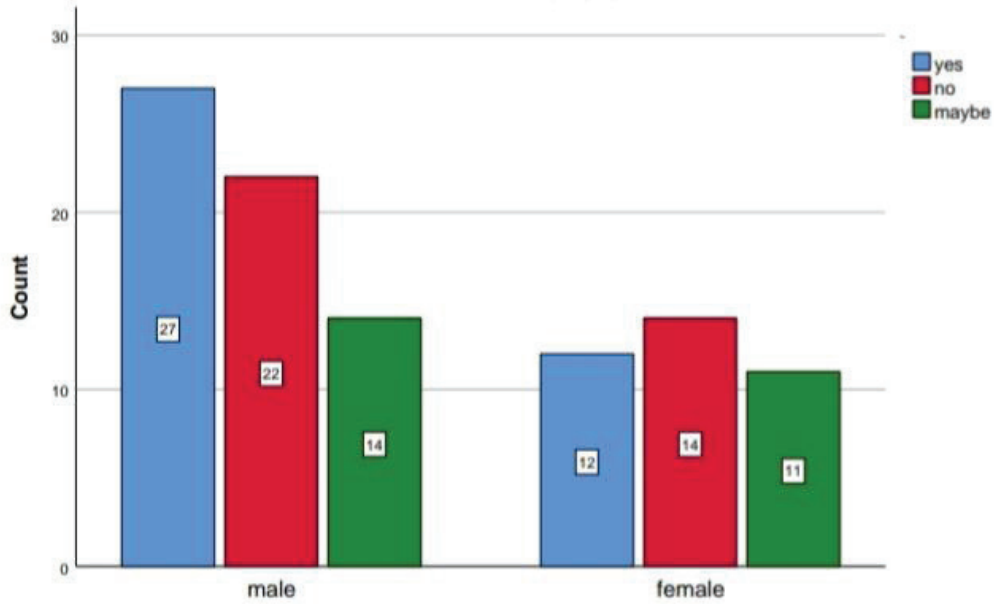

Figure 6: Bar graph showing the comparison of responses based on gender to the questions on the benefits of AI to the doctors, where blue represents yes, red represents no and green represents maybe. Majority of the responses (27%) were given by males. X-axis represents the gender of the participants and Y-axis represents the frequency. There is no significant difference in responses between gender. Pearson Chi square value - 1.230, P value - 0.541. (p>0.05- Statistically not significant).

The questionnaire is distributed and various responses have been collected for each and every question. The results were statistically studied and were analysed.

In figure 1, it shows about the awareness of AI in dentistry, Blue represents 62% student says that they are aware and Red represents 38% student says that they are not aware. In figure 2, it shows the beneficial of AI towards doctors, Blue represents 39% student says yes, Red represents 36% student says no and Orange represents 25% student says maybe. In figure 5, it shows about AI, as a confidentiality and data security, a major threat, blue represents 44% student says yes, Red represents 38% student says no and Orange represents 18% student says maybe. In figure 3, Chi square test was done to analyse association between gender and knowledge of full form of AI, in which 27% of males and 14% of females were aware(p value=0.615). It was found statistically not significant. In figure 4, Chi square test was done to analyse association between gender and the technology of AI, in which 23% of males and 16% of females were aware (p value = 0.085). It was found statistically not significant. In figure 5, Chi square test was done to analyse the association between gender and awareness of AI in dentistry, in which 37% of males and 25% of females were aware (p value= 0.379). It was found statistically not significant. In figure 6, Chi square test was done to analyse association between gender and knowledge of AI beneficial to doctors, in which 27% of male and 12% of females were aware(p value=0.541). It was found statistically not significant.

The present research interest was initiated from the team of investigators where previous studies were done based on clinical reports, interventional studies like [11 12 13], in vitro studies like, [6 7 8 10] and systematic reviews [11 14 15 16 16,17 18]. Compared to the previous studies. When said about the results of AI are accurate, Mcgrath SP [19], et al, in the year 2001 said that machines as a classification of dental images and visual search, 57% accuracy is observed when humans classify images. But 84% accuracy is observed when the machine classifies the image.

When said about AI that is helpful in diagnosis, Alexander L. Fogel [20], et al, in the year 2018, says that AI is described in prevention, detection, diagnosis and treatment of diseases, 57% says that it is helpful for AI diagnosis and is revolutionised in an article titled as Artificial Intelligence as power and digital science - A

review. Even Lin K [20 21] , et al, in the year 2020, said that AI improves outcomes, detection and diagnosis of oral cancer by 53%, was said in an article titled as Improving oral cancer and outcomes and imaging through AI - A review.

When said about AI as a threat, Andreas Holzinger [22] , et al, in the year 2019, says that AI enhance trust in medical professionals as future systems in our body and 49% feel that AI technology as a threat, in an articles titled as Causability and Explainability of AI in medicinal field - a review. Thus, in the above articles, most of the results from the previous literature are more or less similar to the results of this survey .

The limitations of this study is that the questionnaire may contain error captions. Due to the small scale of sample size, results may vary. The future scope of this study is that the present data has 100 responses. The sample size is small, among the general population. In future, more numbers of sample size can be used to study different types of population and for better results [23] .

Conclusion

AI has the potential that can be applied in various fields of science. There is a growing demand in the field of medicine, for AI to approach as transparent, trustworthy, etc for human experts in medicine. Thus, the participants of this study were aware about the usage of AI in the field of Dentistry.

Acknowledgement: The Author would like to thank the study participants for their participation and kind cooperation.

Conflict of Interest: The Author declares that there was no conflict of interest in the present study.

Source of Funding: Self.

Ethical Clearance: Not Required

References

1. Jyothi S, Robin PK, Ganapathy D, Anandiselvaraj. Periodontal Health Status of Three Different Groups Wearing Temporary Partial Denture [Internet]. Vol. 10, Research Journal of Pharmacy and Technology. 2017. p. 4339. Available from: http://dx.doi.org/10.5958/0974-360x.2017.00795.8
2. Khanna S, Sattar A, Hansen D. ADVANCES IN ARTIFICIAL INTELLIGENCE RESEARCH IN HEALTH [Internet]. Vol. 05, Australasian Medical Journal. 2012. Available from: http://dx.doi.org/10.21767/amj.2012.1352
3. Deshmukh S. Artificial intelligence in dentistry [Internet]. Vol. 10, Journal of the International Clinical Dental Research Organization. 2018. p. 47. Available from: http://dx.doi.org/10.4103/jicdro.jicdro_17_18
4. Simon HA. Artificial intelligence: an empirical science [Internet]. Vol. 77, Artificial Intelligence. 1995. p. 95–127. Available from: http://dx.doi.org/10.1016/0004-3702(95)00039-h
5. Singh J, Intelligence A. Research Paper on Artificial Intelligence [Internet]. International Journal of Scientific Research and Management. 2017. Available from: http://dx.doi.org/10.18535/ijsrm/v5i11.10
6. Duraisamy R, Krishnan CS, Ramasubramanian H, Sampathkumar J, Mariappan S, Navarasampatti Sivaprakasam A. Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant Dent. 2019 Jun;28(3):289–95.
7. Ganapathy D, Sathyamoorthy A, Ranganathan H, Murthykumar K. Effect of Resin Bonded Luting Agents Influencing Marginal Discrepancy in All Ceramic Complete Veneer Crowns. J Clin Diagn Res. 2016 Dec;10(12):ZC67–70.
8. Ranganathan H, Ganapathy DM, Jain AR. Cervical and Incisal Marginal Discrepancy in Ceramic Laminate Veneering Materials: A SEM Analysis. Contemp Clin Dent. 2017 Apr;8(2):272–8.
9. Ashok V, Suvitha S. Awareness of all ceramic restoration in rural population [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1691. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00340.1
10. Ajay R, Suma K, Ali S, Sivakumar JK, Rakshagan V, Devaki V, et al. Effect of surface modifications on the retention of cement-retained implant crowns under fatigue loads: An In vitro study [Internet]. Vol. 9, Journal of Pharmacy And Bioallied Sciences. 2017. p. 154. Available from: http://

dx.doi.org/10.4103/jpbs.jpbs_146_17

11. Ariga P, Nallaswamy D, Jain AR, Ganapathy DM. Determination of Correlation of Width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A Systematic Review [Internet]. Vol. 9, World Journal of Dentistry. 2018. p. 68–75. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1509
12. Ashok V, Nallaswamy D, Benazir Begum S, Nesappan T. Lip Bumper Prosthesis for an Acromegaly Patient: A Clinical Report. J Indian Prosthodont Soc. 2014 Dec;14(Suppl 1):279–82.
13. Venugopalan S, Ariga P, Aggarwal P, Viswanath A. Magnetically retained silicone facial prosthesis. Niger J Clin Pract. 2014 Mar;17(2):260–4.
14. Selvan SR, Ganapathy D. Efficacy of fifth generation cephalosporins against methicillin-resistant Staphylococcus aureus-A review [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1815. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00369.3
15. Subasree S, Murthykumar K, Dhanraj. Effect of Aloe Vera in Oral Health-A Review [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 609. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00116.5
16. Vijayalakshmi B, Ganapathy D. Medical management of cellulitis [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 2067. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00422.4
17. Ganapathy DM, Kannan A, Venugopalan S. Effect of Coated Surfaces influencing Screw Loosening in Implants: A Systematic Review and Meta-analysis [Internet]. Vol. 8, World Journal of Dentistry. 2017. p. 496–502. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1493
18. Kannan A, Venugopalan S. A systematic review on the effect of use of impregnated retraction cords on gingiva [Internet]. Vol. 11, Research Journal of Pharmacy and Technology. 2018. p. 2121. Available from: http://dx.doi.org/10.5958/0974-360x.2018.00393.1
19. Carmody DP, McGrath SP, Dunn SM, van der Stelt PF, Schouten E. Machine Classification of Dental Images with Visual Search [Internet]. Vol. 8, Academic Radiology. 2001. p. 1239–46. Available from: http://dx.doi.org/10.1016/s1076-6332(03)80706-7
20. Fogel AL, Kvedar JC. Artificial intelligence powers digital medicine [Internet]. Vol. 1, npj Digital Medicine. 2018. Available from: http://dx.doi.org/10.1038/s41746-017-0012-2
21. Ilhan B, Lin K, Guneri P, Wilder-Smith P. Improving Oral Cancer Outcomes with Imaging and Artificial Intelligence [Internet]. Vol. 99, Journal of Dental Research. 2020. p. 241–8. Available from: http://dx.doi.org/10.1177/0022034520902128
22. Holzinger A, Langs G, Denk H, Zatloukal K, Müller H. Causability and explainability of artificial intelligence in medicine [Internet]. Vol. 9, WIREs Data Mining and Knowledge Discovery. 2019. Available from: http://dx.doi.org/10.1002/widm.1312
23. Basha FYS, Ganapathy D, Venugopalan S. Oral Hygiene Status among Pregnant Women [Internet]. Vol. 11, Research Journal of Pharmacy and Technology. 2018. p. 3099. Available from: http://dx.doi.org/10.5958/0974-360x.2018.00569.3